Sept. 1, 1964 R. KOCHAR 3,146,677

SHAPING AND SLOTTING MACHINES

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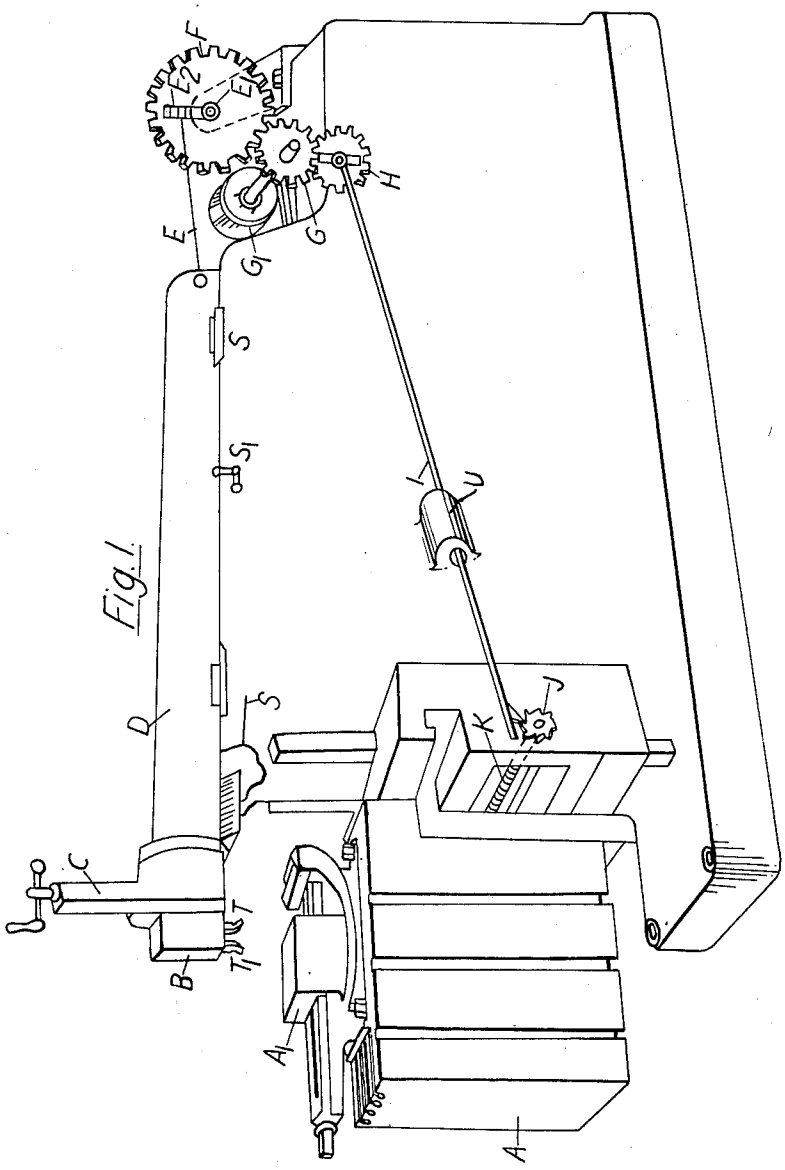


Fig. 1

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Fig. 2A.

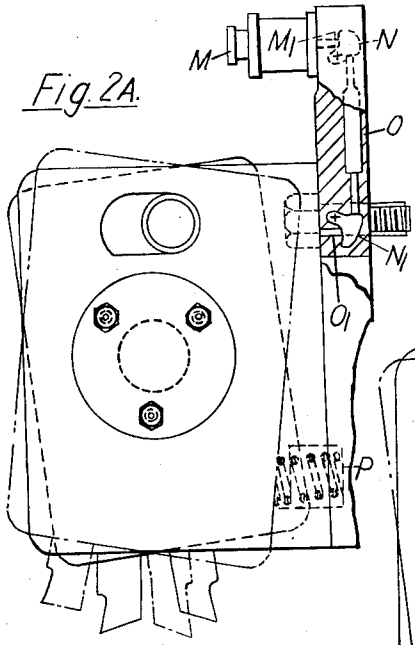


Fig. 2.

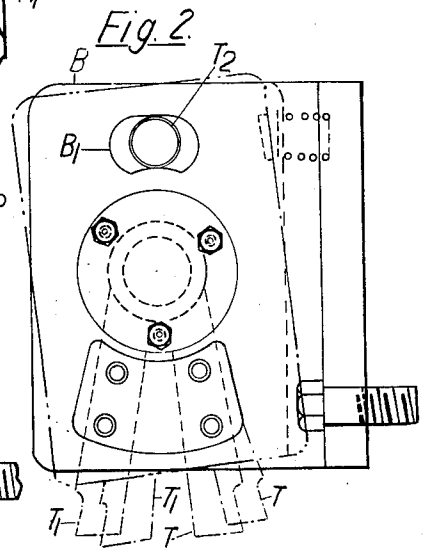
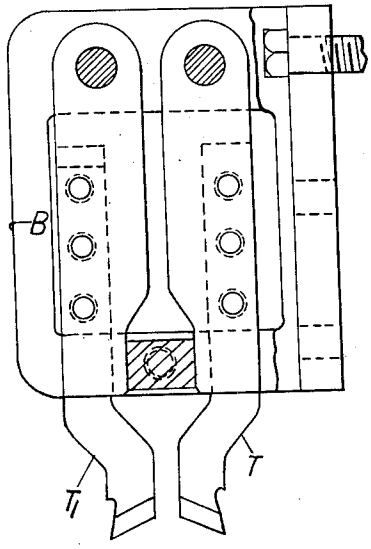


Fig. 3.



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SHAPING AND SLOTTING MACHINES

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4 Claims. (Cl. 90—40)

This invention relates to improvements in reciprocating devices such as slotters and shapers.

It is an object of the invention to modify the conventional machines such that their production capacity is increased.

In the known shapers and slotters there is one cutting stroke and one idle return stroke. The drive mechanism of the known machines is so designed that the time taken by the return idle stroke is less than the time taken by the cutting stroke. It will thus be seen that if the idle stroke is converted into a cutting stroke the production efficiency of the machine will improve.

The known machines are provided with a conventional whitworth quick-return mechanism for driving the ram. The ratio of the return speed to the forward speed (the return speed being higher) is effected by the length of the stroke. This ratio for normal working conditions can be assumed as 3:1.

The feed screw which ensures the cross movement of the work table is actuated by a pawl and ratchet arrangement connected by a lever to an operating gear which performs one complete revolution for a complete cycle of the tool post.

According to this invention the ram carrying the tool post is driven by a slider-crank mechanism wherein the fulcrum of the crank is on the center line of the ram whereby the speed of the ram in the forward and the return stroke is made uniform. On the tool post of the machine are mounted at least two opposed cutting tools with means provided for causing one of the said cutting tools to become operative at the forward stroke and the other at the return stroke of the ram, the positioning of the said tools being dependent upon the direction of travel of the ram, the cross feed to the work table being effected through gearing and linkage such that the work table is fed across the center line of the ram with every change of direction of the ram.

This improved design has lesser wearing parts, is cheaper to manufacture and easier to maintain. The power is transmitted from the motor to the ram directly through a gear and link arrangement. No die blocks or slideways which add to friction and consequent reduction in the total available power are provided and thus the horsepower of the drive motor is more effectively utilized.

According to an embodiment of the invention the tool post carries two tools one behind the other in the same center line as the machine ram, the cutting edges of the said tools being opposed to each other. The tools are operated by a magnetic solenoid tool lifting device comprising a trip switch mounted on the ram guideway causing the solenoid to function whereby through a set of levers and cams, one of the two tools is brought to a cutting position, the other tool being in turn brought to the cutting position in the alternate strokes by a compression spring.

According to a further embodiment of the invention tools are mounted in a rotating clapper box on the tool post in a plane at right angle to the center line of the ram, the positioning of the said two tools for the cutting action being effected in the manner described above.

The invention will now be more fully described with reference to the accompanying drawings in which:

FIG. 1 shows schematically in perspective a shaper wherein the ram carrying the tool post is operated by a slider-crank arrangement.

FIG. 2 shows two tools mounted on a rotatable clapper box in a plane at right angles to the plane of the machine ram.

FIG. 2A shows a solenoid and compression spring arrangement for positioning the two tools.

FIG. 3 shows the clapper box with two tools, mounted one behind the other.

Referring to the drawings, A is the work table of a shaping machine. A_1 is the usual machine vise. B is the clapper box fitted on a tool post C. A ram D is reciprocated by a crank E_1, E_2 through a connecting link or lever E. The fulcrum E_1 of the said crank is coaxial with the shaft of a gear wheel F and is also on the center line of the ram. The gear wheel F is driven by a pinion G mounted on the shaft of a motor G_1. The stroke of the ram or slider D can be adjusted by changing the fulcrum position of the lever E on the gear wheel F.

The tool post C is preferably integrally formed with the ram D. Alternatively the said tool post may be rigidly secured to the ram D so that it is capable of resisting the tensile force imposed thereon while the cutting action is performed on the return stroke of the ram D.

The work table A is fed across the center line of the ram D by a feed screw K. The feed screw is operated by a pawl and ratchet arrangement J, through a lever or link I supported by a bearing U, said lever I being connected to a feed gear H operated by the motor G_1 through the pinion G. The gearing and linkage between the driving pinion G and the feed screw K and ram D respectively is such that the work table A is fed across the center line of the ram with every change of direction of movement of the ram. In this respect gear H makes two complete revolutions for each revolution of gear F such that at the end of each stroke of the ram D, the work table is fed crosswise a desired increment. The stepwise feed of the table is insured by the pawl and ratchet arrangement J.

It is important that the fulcrum E_1 of the crank E_1, E_2 be on the center line of the ram D. The driving arrangement is referred to as a slider-crank mechanism.

Referring to FIG. 2 which shows the arrangement for positioning the cutting tools T, T_1, this comprises a rotatable clapper box B having a guide slot B_1 which is engaged by guide pins T_2 carrying the tools T, T_1. The guide slot B_1 limits the angular movement of the tools T and T_1 and as illustrated when one tool is operative the other one is clear of the work piece. Means for causing the guide pins T_2 to move in the guide slot B_1 comprise an arrangement of a magnetic solenoid and a compression spring as shown in FIG. 2A.

Referring to FIG. 2A, M represents a solenoid having a plunger M_1 acting on a cam N which in turn is adapted to actuate a plunger O_1 through a lever O and a cam N_1. The solenoid M is energized by a trip switch S (FIG. 1) mounted on the guideways of the ram D. The ram D carries a pin S_1 which trips one of the two connected switches S at the end of the stroke of the said ram thus causing the solenoid M to be energized and thereby operating the plunger O_1 through the cam and lever arrangement as shown. At the end of the return stroke the pin S_1 trips the switch S in the opposite direction thus deenergizing out the solenoid arrangement. The opposite tool is then brought into position mechanically by the compression spring P. In the arrangement shown in FIG. 2 the tools are mounted on the clapper box in a plane at right angles to the center line of the ram. The cutting edges of these tools are opposed to each other.

Referring to an alternative arrangement shown in FIG.

3, the two tools T, T_1 are mounted in the clapper box B so that the cutting edges are on the same center line as the machine ram D and their cutting edges are opposed to each other. The arrangement for positioning the tools is the same as in FIG. 2A.

It will be realised that by the modified design of the shaper or slotter one of the two cutting tools will be operative in either stroke of the ram.

The general arrangement and working details of a slotting machine are identical to that of a shaping machine except that the work table in a shaping machine travels across the center line of the ram to provide the feed while in the case of a slotting machine it rotates in a plane at right angles to the ram. For the purposes of the proposed modification, the two machines are being treated as of an identical design and the arrangement disclosed is confined to a shaping machine.

I claim:

1. A machine comprising a ram, means for reciprocating said ram to provide forward and return strokes therefor, two cutting tools, means supporting said tools on said ram facing in opposite direction on a line parallel to the direction of said strokes of said ram, means for supporting a workpiece in operative association with said tools whereby a cutting function can be provided on said workpiece during each stroke of the ram, means coupled to the means supporting the tools for alternately moving the tools in said means to operatively position a successive tool with respect to said workpiece for each stroke of the ram whereby each tool is adapted for performing a cutting operation on the workpiece for alternate strokes of the ram, and means coupled to the means supporting the workpiece for moving the same crosswise of the ram at the completion of each stroke of the ram, the latter means including a pawl and ratchet arrangement, a feed gear for driving the pawl and ratchet arrangement, and a driving pinion for operating the feed gear, said driving pinion being coupled to the means for reciprocating said ram, such that the workpiece is fed crosswise of the ram with every change of direction of movement of the ram.

2. A machine as claimed in claim 1 in which the means for reciprocating the ram comprises a slider crank mechanism having a fulcrum in line with the ram, said means supporting the two tools including a clapper box, means supporting the clapper box for limited turning through a predetermined angle, a guide pin supporting the tools and being accommodated in a guide slot provided in the clapper box which limits the angular movement of the said tools such that when one tool is operative, the other is clear of the workpiece, the means for moving the tools including a magnetic solenoid operative by said ram and coupled to the clapper box for moving the same for one direction of stroke of the ram to a position in which a first tool is operative and the other tool is clear of the workpiece and a compression spring for returning the clapper box to the original position thereof when said solenoid is deenergized for the other direction of stroke of the ram in which the other of the tools is operative and said first tool is clear of the workpiece.

3. A machine as claimed in claim 2 wherein said tools have diametrically opposed cutting edges and said means for moving the tools further comprises a trip switch mounted in the path of the ram and coupled to the solenoid to energize the same for a stroke in one direction of the ram whereby through a set of levers and cams, the first of the two tools is brought into a cutting position for the stroke in said one direction while the tool is brought into a cutting position by the compression spring in the stroke in the other said direction.

4. A machine as claimed in claim 2 comprising switches controlling the magnetic solenoid of the clapper box, said switches being supported in the path of the ram adjacent the end position of the strokes thereof for being tripped in response to the direction of movement of the ram, so that the solenoid is energized during alternate strokes of the ram.

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